National Polar-orbiting Operational Environmental Satellite System (NPOESS) Potential Pre-planned Product Improvement (P3I) Status

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The NPOESS spacecraft is designed to provide ample resource margins that can be used to support Potential Pre-planned Product Improvement (P3I). The P3I Program Plan supports the infusion of new satellite observational technologies, and the validation of new capabilities. This paper discusses status of the NPOESS spacecraft P3I resources and the planned processes for P3I implementation. In addition, the sensor interface requirements, the sensor information package needs, the schedule and milestones requirements for the NPOESS flights are discussed. The information will be used for the preliminary technical assessment by the government of candidate instruments/experiments programs. This P3I effort is ongoing and the material in this report provides a status of the work.

I. Introduction

The NPOESS satellite employs a modular architecture and has the flexibility to accommodate requirements changes, technology insertions, and candidate instruments/experimental programs. The candidate instruments/technology include the 21 P3I Environmental Data Records (EDRs) identified in the NPOESS Technical Requirements Document (TRD) Appendix G and is summarized in Table 1.

Table 1. Potential NPOESS EDRs not Currently Addressed by the NPOESS Sensor Suite

Tropospheric Winds		Carbon Dioxide Column
Methane Column		Carbon Monoxide Column
Optical Background		All Weather, Day/Night Imagery
Bathymetry		Bioluminescence Potential
Salinity		Coastal Ocean Color
Littoral Currents		Coastal Sea Surface Wind/Wind Stress
Coastal Sea Surface Temperature		Ocean Wave Characteristics
Coastal Sea Surface Height		Surf Conditions
Oil Spill Location		Vertical Hydrometer Profile
Sea and Lake Ice Characteristics		Neutral Winds
Coastal Imagery		

As the NPOESS Program proceeds towards spacecraft design and integration of baseline instruments, a study is also in place to develop and execute a process to best use the planned P3I capabilities of the NPOESS platform. This report provides a status report of the allocated and potential spacecraft resources that can support P3I, technology, and candidate sensor insertion.

II. NPOESS Satellites Manifests and Sensor Accommodation Design

The NPOESS satellite constellation consists of 3 satellites in 828 km altitude, sun synchronous, 1330, 1730 and 2130 orbits. The satellite payload manifests are shown in Table 2.

III. Table 2. NPOESS Satellite Payload Manifests		
1330	**1730**	**2130**
Visible/Infrared Imager/Radiometer Suite (VIIRS)	VIIRS	VIIRS
Conical Scanning Microwave Imager Sounder (CMIS)	CMIS	CMIS
Cross Track Infrared Sounder (CrIS)	CrIS	
Advanced Technology Microwave Sounder (ATMS)	ATMS	
Space Environment Sensor Suite (SESS)		
Global Positioning System Occultation Sensor (GPOSO)		
Survivability Sensor (SS)	SS	SS
Search And Rescue Satellite Aided Tracking (SARSAT)	SARSAT	SARSAT
Advance Data Collection System (ADCS)	ADCS	
Earth Radiation Budget Sensor (ERBS)		
Ozone Mapping and Profiler Suite (OMPS)		
	Altimeter (ALT)	
	Total Solar Irradiance Sensor (TSIS)	
		Aerosol Polarimetry Sensor (APS)

The spacecraft sensor accommodation design is driven by mission data and cold space Field-Of-View (FOV) requirements. In order to support various satellite back-up requirements, the NPOESS satellites employ one deck space design, with same sensor locations, for all three orbits. The electrical power and command and data handling support are also the same for each satellite.

Table 3. NPOESS Satellite Deck Space Status (August, 2004)			
NPOESS Orbit	**2130**	**1330**	**1730**
Available Deck Space Estimate	2.78 m^2	1.56 m^2	0.42 m^2

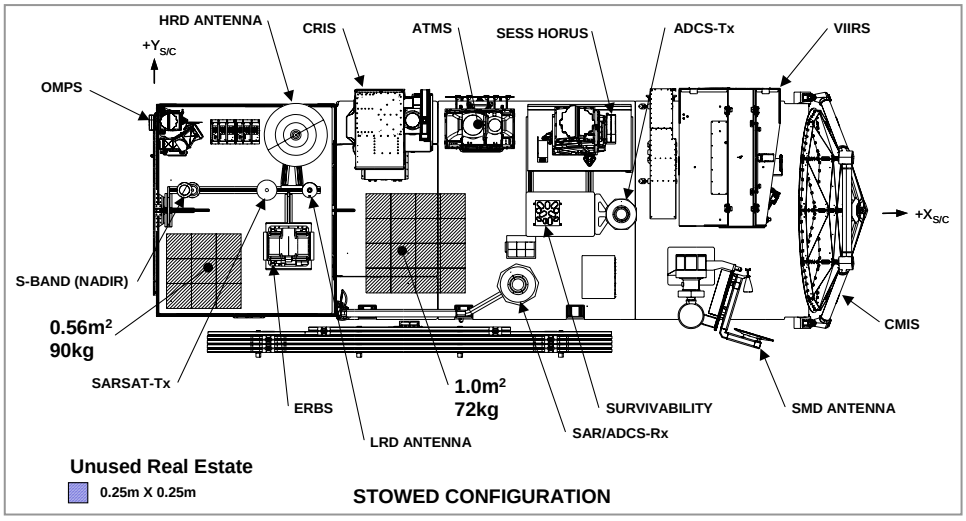

Figure 1. Location of Available Deck Space and Associated Mass Supported by the Deck Structure on the NPOESS 1330 Satellite (August, 2004)

The NPOESS satellites have dedicated resources to support P3I sensors. These resources include aggregated mass, power, and data rate. The nadir deck space available for P3I sensors include vacated space summarized in Table 3. The corresponding mass the satellite deck structure can support is shown in Figure 1, 2, and 3. Use of the vacated deck space is subject to NPOESS satellite back-up requirements that will be determined late in the development schedule. Figures 1, 2, and 3, provide the locations of the potential nadir deck spaces for P3I sensors. Viability of these locations depend on detailed structure and coupled load analysis.

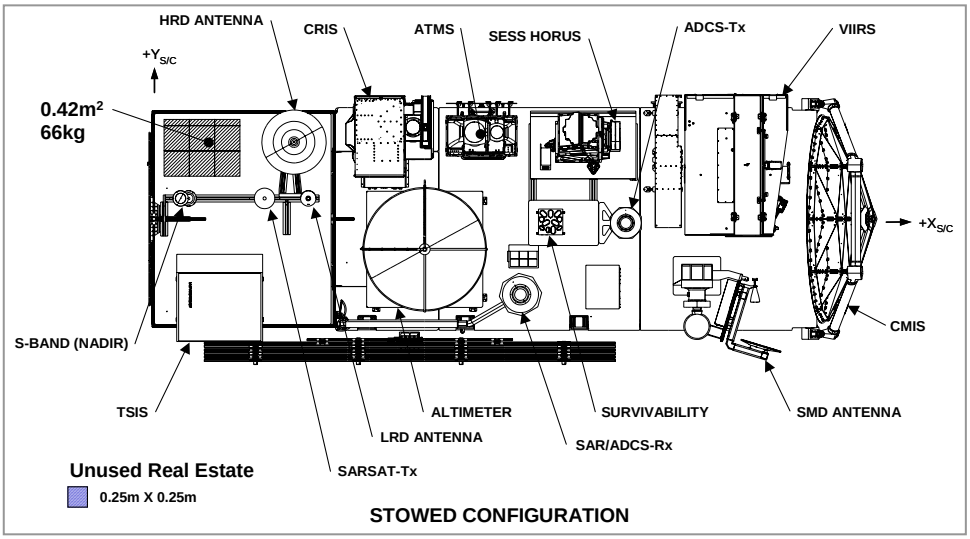

Figure 2 Location of Available Deck Space and Associated Mass Supported by the Deck Structure on the NPOESS 1730 Satellite (August, 2004)

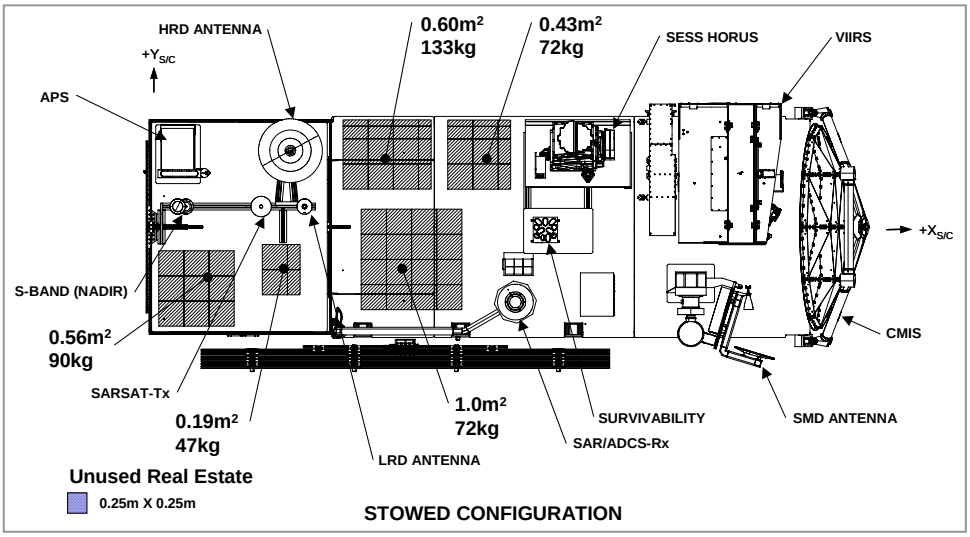

Figure 3. Location of Available Deck Space and Associated Mass Supported by the Deck Structure on the NPOESS 2130 Satellite (May 2004)

The NPOESS satellite designs have dedicated 340 watts to support P3I sensors (Table 4). The power allocation will be provided to the P3I sensors via four unregulated 28 volts services, primary and redundant lines included. The status of the NPOESS satellite power margins, at 9 months to spacecraft PDR, is as shown in Table 4.

Table 4. NPOESS Satellite Power Budget Status (July, 2004)			
NPOESS Orbit	**2130**	**1330**	**1730**
P3I Sensor Power Allocation (W)	326	326	326
Satellite Power Margin (W)	1,407	234	1,013

The NPOESS satellites have allocated 365 kg to support P3I sensors (Table 5). The allocation is the total mass attributed to the P3I sensor addition. The maximum masses that can be supported at the available locations are subject to the local load limit of the deck. The status of the NPOESS satellite mass margins is provided in Table 5.

Table 5. NPOESS Satellite Launch Mass Status (July, 2004)			
NPOESS Orbit	**2130**	**1330**	**1730**
P3I Sensor Mass Allocation (kg)	365	365	365
Satellite Mass Margin (kg)	609	189	216

The NPOESS satellite employs both 1553 and 1394 data buses to support sensor mission and housekeeping data needs. Both 1394- and 1553-bus data ports are available to support the P3I sensors and data rate allocations are detailed in Table 6. The data rate allocation is for both the realtime (High Rate Data) HRD X-band down link and for the stored (Stored Mission Data) SMD Ka-band down link.

Table 6. NPOESS P3I Sensor Data Rate Status (July, 2004)			
NPOESS Orbit	**2130**	**1330**	**1730**
P3I Data Rate 1394 (Mbps)	3.2	3.2	3.2
P3I Data Rate 1553 (Kbps)	200	200	200

The design and accommodation of the P3I sensors shall neither impact the performance of the NPOESS baseline sensors nor shall the P3I sensor schedule impact the baseline launch schedule. Figure 4 provides the preliminary schedule guidelines for P3I sensor spacecraft integration evaluation and engineering. The initial P3I sensor accommodation request date and the detailed schedule durations are to be finalized in the IPO P3I Announcement of Opportunity. P3I sensor planning for NPOESS C2-6 is in progress and will be made available when completed.

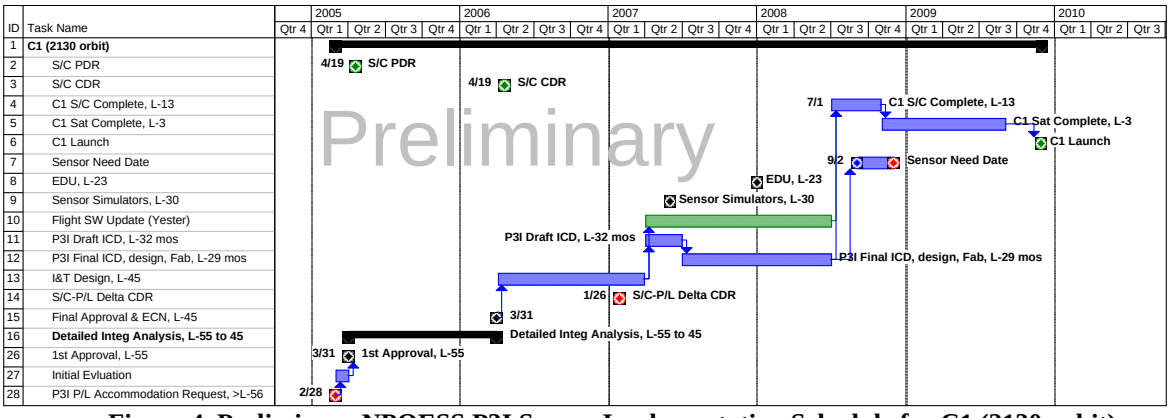

Figure 4. Preliminary NPOESS P3I Sensor Implementation Schedule for C1 (2130-orbit)

IV. Conclusion

The NPOESS satellites have the resources to accommodate technology insertions, and candidate instruments/experimental program sensors. A study is in place to develop and execute a process to best use the planned capabilities of the NPOESS platform. This report provides a status report of the allocated and potential spacecraft resources that can support technology, and candidate sensor insertion.

Acknowledgments

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